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The following is to report on a new process for the separation of isotope mixtures, which has been tested on the separation of the isotopes of neon. The process makes use of diffusion through a porous wall into a vacuum, which has already been often used for this purpose. It makes possible the simultaneous action of a large number of diffusion cells, and through this an extensive separation of the isotope mixture in a single operation. The apparatus consists of a large number of separating units, of which each contains two clay pipes sealed into glass tubes and one mercury vapor ejector. In Figure 1, which shows the arrangement of such an apparatus with four separating units, the individual separating units are separated from each other by dotted lines. We will use the third separating unit to explain the method of action. The gas mixture flowing in the direction of the arrow at A first flows through the clay pipe R. A third of the gas mixture is sucked off through the wall of this clay pipe at B, by means of pump P_4 of the neighboring fourth separating unit at the right. This sucked off gas is concentrated with the lighter isotope. The remaining gas then flows through clay pipe S. Another third is sucked off at C through the wall of this pipe and returned to the same circulation at A by pump P_3. The remaining third is concentrated with the heavier isotope, and then flows from D to the second separating unit at the left. The procedures in the other separating units take place in exactly the same manner. Since each separating unit receives gas from its two adjacent units and gives off gas to both of them, a stationary state

is attained. In this state the concentration ratio of the two isotopes is changed from separating unit to separating unit by one factor which is approximately equal to the ratio of the molecular weights.

The arrangements made at the two ends of the series are seen in the figure. On both ends the gas circulates through a storage container, V_s or V_l. An isotope mixture is found in the stationary state in V_s, which is concentrated with the lighter isotope. The ratio of the concentration conditions in V_s and V_l amounts to approximately $\left(\frac{m_s}{m_l}\right)^n$ in a stationary state, where m_s and m_l are the molecular weights and n is the number of separating units. Regulatory installations are unnecessary since the described current state adjusts itself as a result of the pumping action. In the experimental apparatus which was constructed, the possibility is given at the ends by suitable cock connections to insert at random containers of different size. A large change in the isotope ratio as compared to the original mixture, is obtained if the one container selected is very large (30 liters) and the other very small (0.2 liters). The pressure during the experiments was about 10 millimeters Hg.

The experimental apparatus comprises 24 separating units. It resulted in a change of the isotope ratio by an approximate factor 8 in its application to the isotopes of neon. This is close to the expected value of $(1.1)^{24}$. By using the process once, either a mixture could be produced in 8 hours from normal neon with an isotope ration of 10:1, which contained the two

isotopes in the ratio of about 10:8, or one which contained only about 1 percent of the heavy isotope. The composition was tested by a mass spectrograph and by the optical spectrum. In Figures 2 and 3 the spectra of two fractions produced with a Perot-Fabry-Standard instrument are reproduced, each of which is obtained by a single application of the process. Figure 2 shows the spectrum of the isotope 20 alone, Figure 3 that of a fraction which contains the isotopes 20 and 22 in the approximate ratio of 10:8.

1. Separating Unit 2. Separating Unit 3. Separating Unit 4. Separating Unit

Figure 1: Diagram of the separating apparatus 1/10 of actual size.

Figure 2: Spectrum of neon 20

Figure 3: Spectrum of neon 20 and neon 22.

On the mass spectra of the heavier fractions, taken according to the parabola method, a parabola corresponding to the atomic weight of 23 is present, next to the isotopes 20 and 22 and in addition to the already known isotope 21. Whether this involves a further neon isotope can only be decided with certainty by further concentration. It would have to be present in normal neon in about the ratio of 1:2000.

A more complete paper concerning the experiments described here will appear in the Zeitschrift für Physik.

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